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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/904,131	07/11/2001	Tetsuzo Ueda	53074-026	2396

7590

06/01/2006

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EXAMINER
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SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1722

DATE MAILED: 06/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/904,131

Applicant(s)

UEDA, TETSUZO

Examiner

Matthew J. Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.138(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 11,24-26 and 28-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11,24-26 and 28-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/21/2006 has been entered.

### ***Withdrawn Rejections***

2. Applicant's arguments, see pages 4-5, filed 3/21/2006, with respect to the rejection(s) of claim(s) 11 under 35 U.S.C 102(b) and claims 11, 24-26 and 28-32 under 35 U.S.C 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Iida et al (JP 53-028374).

### ***Claim Objections***

3. Claims 26 and 28-30 recites the limitation "the bowing" in line 2. There is insufficient antecedent basis for this limitation in the claim. The examiner suggests deleting "the" and replacing with "a".

### ***Claim Rejections - 35 USC § 103***

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4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 11 and 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Molnar (US 6,086,673) in view of Iida et al (JP 53-028374), an English Abstract has been provided.

In a method of producing quality III-V nitride substrates, note entire reference, Molnar teaches a wide range of growth substrates, which includes sapphire and silicon. Molnar also teaches the growth substrate can consist of layered structures composed of combinations of these materials (col 7, ln 1-20), this suggests applicant's layered substrate of sapphire and silicon. Molnar also teaches deposition of an epitaxial GaN layer (col 10, ln 55-67), this clearly suggest applicant's epitaxial layer comprises group III nitrides. Molnar also teaches removing the sapphire substrate by etching, electrochemical polishing or by another suitable method (col 11, ln 25-55).

Molnar does teach using sapphire and silicon substrates and layered combinations of substrate can be used. However, Molnar does not clearly suggest using sapphire and silicon from the list of available materials.

In a method of producing a wafer, note entire reference, Iida et al teaches growing a single crystal or polycrystalline Si only on the back surface of a sapphire single crystal wafer to reduce warpage of the wafer (Abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Molnar by using a layered substrate of sapphire

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and silicon with silicon deposited on the backside of the sapphire substrate to reduce warpage, as taught by Iida et al.

Referring to claims 24-25, the combination of Molnar and Iida et al teaches removing the substrate by electrochemical polishing ('673 col 11, ln 20-40), this clearly suggests applicant's removing comprises mechanical polishing.

6. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Molnar (US 6,086,673) in view of Iida et al (JP 53-028374), an English Abstract has been provided, as applied to claims 11 and 24-25 above, and further in view of Sasaki (US 4,348,803).

The combination of Molnar and Iida et al teach all of the limitations of claim 26, as discussed previously, except the process of forming the layered substrate includes a heating step and the layered substrate exhibits bowing after being cooled down from the heating step. The combination of Molnar and Iida et al teach growing Si on sapphire, however the combination of Molnar and Iida et al does not explicitly teach a heating step.

In a method of forming silicon on sapphire, note entire reference, Sasaki teaches as silicon layer is formed by an epitaxial growth on a sapphire substrate which is heated to a temperature of for example 950°C (col 2, ln 40-55), this clearly suggests applicant's heating step. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Molnar and Iida et al by growing silicon at a temperature of 950°C to produce a silicon layer on sapphire without cracks (col 1, ln 10-45), as taught by Sasaki.

Referring to claim 26, the combination of Molnar, Iida et al and Sasaki does not explicitly teach the layered substrate exhibits bowing after being cooled from the heating step.

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However, the layered substrate is expected to exhibit bowing because of the differences in thermal expansion coefficients of the sapphire and silicon layers and bowing is also expected because the layered substrate taught by Molnar, Iida et al and Sasaki is similar to the layered substrate taught by applicant.

7. Claims 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Molnar (US 6,086,673) in view of Iida et al (JP 53-028374), an English Abstract has been provided, as applied to claims 11 and 24-25 above, and further in view of Olsen et al ("Calculated stresses in multilayered heteroepitaxial structures").

The combination of Molnar and Iida et al teaches all of the limitations of claim 28, as discussed previously, except the claimed thickness of the silicon layer and the epitaxial layer and the claimed wafer bowing.

In a method of calculating stresses in a multilayered structures, Olsen et al teaches a method of determining the radius of bowing based on the properties of the layers forming the multilayered structure using a combination of equations (pg 2543-2544). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Molnar and Iida et al by using the equations taught by Olsen et al to optimize the thickness of the silicon and epitaxial layers to minimize the bowing to obtain the values claimed by applicant.

Referring to claim 31, the combination of Molnar, Iida et al and Olsen et al does not explicitly teach the layered substrate exhibits bowing in a convex manner. However, the layered substrate is expected to exhibit convex bowing because of the differences in thermal expansion

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coefficients of the sapphire and silicon layers, and convex bowing is also expected because the layered substrate taught by the combination of Molnar, Iida et al and Olsen et al is similar to the layered substrate taught by applicant.

8. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Molnar (US 6,086,673) in view of Iida et al (JP 53-028374), an English Abstract has been provided, and further in view of Olsen et al ("Calculated stresses in multilayered heteroepitaxial structures"), as applied to claim 31 above, and further in view of Nakamura (US 5,290,393).

The combination of Molnar, Iida et al and Olsen et al teaches all of the limitations of claim, 32, as discussed previously, except the AlN buffer grown at a lower temperature than the epitaxial layer.

In a method of forming a gallium nitride semiconductor, note entire reference, Nakamura teaches an AlN buffer is formed on a sapphire substrate at a low growth temperature of 400-900°C and then an epitaxial GaAlN layer is formed at a high temperature of 900-1100°C. Nakamura teaches the crystallinity and the surface morphology of a epitaxial layer can be improved by growing the epitaxial layer on the AlN layer as a buffer (col 1, ln 5-67 and claim 1). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Molnar, Iida et al and Olsen et al by using a low temperature AlN buffer to improve the crystallinity and the surface morphology of the epitaxial layer, as taught by Nakamura.

***Response to Arguments***

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9. Applicant's arguments with respect to claims 11, 24-26 and 28-32 have been considered but are moot in view of the new ground(s) of rejection.

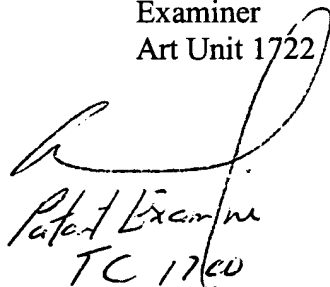
***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song  
Examiner  
Art Unit 1722



Patent Examiner  
TC 1722

MJS  
5/26/2006